oiled and the other as it came from the factory. Both were then placed in the same enclosure containing a saturated vapor. The results were as follows:

Table 2.

Exp. No.	Samples clean.	Samples oiled.	Days under observation.	No. broken clean.	No. broken oiled
4	16	16	33	3	0
5	15	15	12	15	7

Experiment 4 was made on a new spring fresh from the factory while experiment 5 was an old spring which had been lying around in the laboratory and showed rust spots before being oiled. It is quite evident how efficacious the oil is in protecting the springs. It would indicate that jewelers might profitably run a campaign of preventative treatment of watch-springs, where an ounce of prevention would be worth a pound of cure.

It must be borne in mind that not all mainsprings which break are caused to do so by moisture. Some break because of mechanical imperfections. These mechanical imperfections are being picked out by magnetic means here in this laboratory in the hope that we shall be able, by starting with mechanically perfect watchsprings, to reduce the breakage to a minimum by keeping the springs free from moisture.

If one could study the mainspring breakage per capita in different parts of the country it doubtless would be found that the number would be smaller in dry sections than in the humid portions.

The author takes this opportunity of thanking most heartily those jewelers who have so kindly placed at our disposal their records of mainspring replacements.

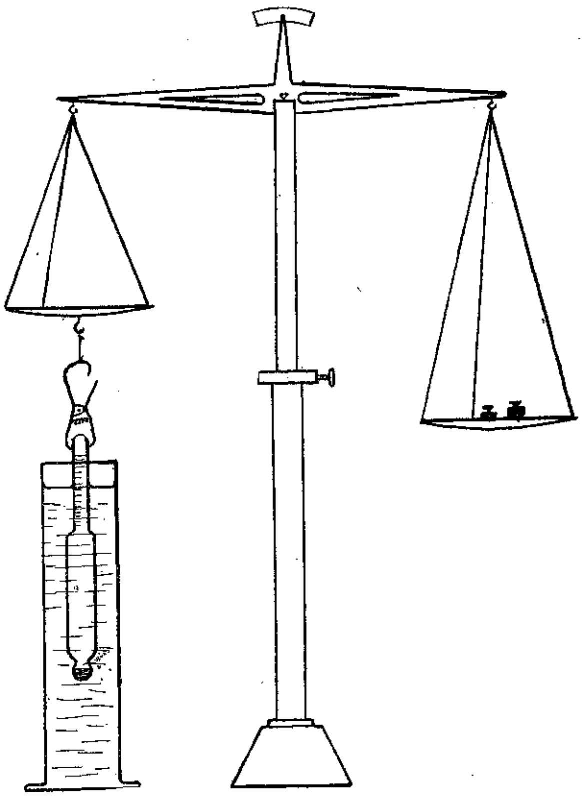
TEST OF A VARIABLE IMMERSION HYDROMETER.

By Paul F. Gaehr,

Wells College, Aurora, N. Y.

In testing such a hydrometer, the simplest procedure is to have a series of stock solutions, whose densities have been accurately measured. This method is very simple for laboratories in which a great deal of this work goes on; but even there, the densities of the solutions is apt to vary on account of evaporation. In the High School laboratory, or the average college laboratory, the storage of a number of stock solutions is usually inconvenient. I have therefore devised an experiment which is capable of great accuracy, and which also helps the student to a better understanding of Archimedes' Law.

For liquids heavier than water: The apparatus required is a jar of water, a spring clamp which will grip the hydrometer stem, and a balance which can be adjusted as to height. Attach the clamp by a light wire or spring to the under side of one of the scale pans and find its weight w. Attach the hydrometer (*not* immersed), and find the combined weight w+H, from which H may be found by subtraction. (The clamp should be as light as possible—preferably not more than 1 gram.) Now bring up the jar of water, allowing the hydrometer to float in the water. Adjust the height of the balance until the beam



is strictly horizontal for a weight H′+w in the other scale pan, this weight being slightly in excess of w. Observe the reading R of the hydrometer. Add 0.2 grams to the weights in the balance, and readjust the balance for horizontality of the beam, and read the new position R, etc., until the entire stem has been covered.

Now take any one case. From H′+w and w we get H′ by subtraction, H′ being the "apparent weight" of the hydrometer in water. $H-H'$ is the weight of the water actually displaced. To find $H-H'$ it is not necessary to go through all the subtractions indicated above, but merely from $(H+w)-(H'+w)$. Now suppose that the hydrometer (without the clamp on top) is placed into a liquid of specific gravity, S, so that the hydrometer sinks to this mark R at which it was held in the water jar, then the weight of the displaced liquid is equal to the weight of the hydrometer, H. The ratio of this weight H to the weight of an equal volume of water, $H-H'$, is the specific gravity of the liquid.

An "Actino-hydrometer" was tested, its scale not being described in any book. It was first tested by being placed in a series of salt solutions, whose specific gravities were carefully determined. It was found that the hydrometer readings, when plotted against specific gravities gave a straight line. Then the specific gravities as determined by the above method were plotted on the same sheet, and three of the points lay on the line, and the remaining point was only slightly off. The data are given here.

$$\begin{array}{rl} H+w & =15.57 \text{ grs.} \\ w & = 4.23 \\ \hline H & =11.34 \end{array}$$

R	H^1+w	$H-H^1$	s
29	4.8	10.82	1.0480
39.5	5.0	10.62	1.0678
53	5.2	10.42	1.0883
67	5.4	10.22	1.1097

If your Jolly balance is of the kind whose lower end is always brought to the same point, the *upper* end of the spring being moved for adjustment, the experiment can be equally well and quickly performed, and with almost the same accuracy.

If the hydrometer to be tested is for *liquids lighter than water*, it becomes necessary to have a wire frame which grips top and bottom of the hydrometer, to the bottom of which is attached a sinker sufficiently heavy to pull the hydrometer down to the top of the stem. In this case it is necessary to find in *each* case the apparent weight of the wire frame, care being taken to have the same degree of immersion of the frame with hydrometer in and out of the jar. This makes the method a little cumbersome. An alternative method is to use the clamp only, attaching the sinker directly to the bottom, and then computing its apparent weight from its specific gravity.

Consideration of the above experiment will show that it has possibilities from the point of view of the teacher, in illustrating thoroughly various applications of the law of Archimedes.